This paper examines the role of digital media in holistic assessment: their contribution to processes and procedures and potential to enhance deep learning and attainment by allowing us to capture, record and analyse data flexibly and quickly. The assessment of knowledge, skills, understanding and performance and the validation of achievement through qualifications is essential for accountability and quality assurance. However, much unhelpful discussion focuses on the schism between assessment **for** learning: a constructive and positive support mechanism, and assessment **of** learning: used by government mainly to measure return on investment.

Digital media offer a way for these high stakes prepositions (**for** and **of**) to become interchangeable so that learning, performance, assessment and validation become a benign continuum that merges objective measurement with constructive process.

By digital media I mean *the full range of digital information processing technologies such as cameras, laptops, PCs and mobile devices that work with digital codes and can create, decode and distribute digital content including audio and video.*

Introduction

External assessment is essential. We will review how digital media can enrich it through instrument development, assessment, validation, awarding, reporting and evidence generation. Figure 1 shows the teaching continuum and the key points where intelligence captured by assessment through digital means can have most impact.

Figure 1: An overview of the teaching cycle and the key points of intervention

Figure 2 shows the conflict between **for** and **of** and **its** relevance to different modes.

Figure 2: The prepositions in action

Assessment for learning	Assessment of learning
Screening	Cumulative performance
Initial	Summative performance
Diagnostic	Terminal performance
On course progression	

When online assessment was first introduced the cautious and the sceptical expressed concerns such as the: lack of technological robustness; impact system failure would have on candidates; barriers on-screen presentation provides for those 'brought up' on text books and exam papers; additional time (on-screen questions were thought to take longer to respond to); limitations of content; internet security issues and risks to the integrity of the process. Ten years on, all but the most recalcitrant have accepted that digital delivery has a critical and crucial role to play in informing learning and modernising the process and branding of assessment and validation. There is growing evidence that digital media support the underpinning principles of **reliability**, **rigour** and **validity** by increasing transparency, comparability, flexibility, scalability and timeliness.

Much of this growing confidence is drawn from the impact of the UK's *Skills for Life Strategy,* which set up the first national intervention to deliver screening, initial and diagnostic assessment using digital tools. The system was designed to link individual learner records with core curricula to facilitate a personalised approach to learning and assessment. It created the UK's first mass-scale on-line external assessment leading to national qualifications delivered by Awarding Organisations (AOs) who used the intelligence gathered to generate feedback for centres and individuals.

Unfortunately its very success has helped to narrow perception and limit exploitation of the role of digital media. Those on-line assessments used fixed response questions to address basic knowledge and understanding, facilitate digital marking, early reporting and flexible access. It was meant to be a 'Trojan Horse' leading to more innovation. It gave us compelling evidence of impact on learner engagement and performance, but remains an approach that was innovative and liberating yet ultimately failed to evolve.

The context – assessment, awarding and reporting

The achievement of qualifications is increasingly high stakes as they visibly measure the performance of the education system and its institutions, teachers and learners. Currently digital media are used mainly to streamline processes and procedures and improve access to learning, assessment, distribution, marking and reporting. Whilst these are operationally important, this application of digital media is propping up an increasingly negative, obsolete and redundant model. They should offer innovative, even revolutionary yet sustainable approaches, facilitate learning and robustly underpin progression. Stages in the continuum where they should be involved include:

✓ **the development of assessment instruments:** by working on-line pace can be increased; pre-testing can be enhanced; access to the range of expertise can be increased; the diversity of evidence requirements can be expanded; and the development of digital assessment instruments will ensure they maximise the opportunities technology offers rather than being superimposed at a later stage

- ✓ determining **what can be assessed through digital media:** the nature of assessment, the credibility of its purposes and the viability of evidence; the demands of the assessment system; and the balance between digital media and other approaches must all be fit for purpose
- ✓ **monitoring and capturing candidate performance** during the process going beyond correct and incorrect to include: what was answered accurately first time and quickly; what took several revisions; how long it took to complete; monitoring and measuring comparable performance across candidates, questions and tests
- ✓ determining **where and how the assessment is undertaken and evidence collected** including: remote assessment using video; evidence over time including audio and video recordings; distribution on-line or through e-assessment; live assessment of performance in real or simulated contexts
- ✓ securing **consistency and security in the marking processes and procedures** including: distribution of assessment instruments to assessors and centres; collection and distribution of assessment evidence; analysis of question performance including variations on reliability, rigour and validity; variations in assessor performance and the potential impact on individual attainment and progression; variations in assessment instruments' performance and their credibility; use of virtual professional groups of markers to air these issues and provide greater professional coherence and community
- ✓ providing **information to improve the learning continuum and future performance** through data and information that can be interrogated by: an AO's assessors and examiners; by practitioners and managers; by learners themselves; by parents and employers, all with their own particular priorities for what they need to discover or know
- ✓ facilitating **easier, faster and more flexible recording, reporting and awarding** as technology can respond more directly to the changing demands of employers, progression partners and the education and training system. This means providing: flexible access to assessment and its outcomes; meaningful, tangible and timely reports on performance; and evidence beyond and outside traditional norms, responding to the increasingly different rhythms of learning and reporting cycles.

Actors in the assessment arena

The actors and beneficiaries involved at each stage include:
- ✓ **learners and candidates** whose knowledge, skills, understanding, and their implementation through performance, are monitored and measured
- ✓ **teachers, tutors and trainers** who need access to learners and to the data, information and tools necessary to support their progress across different contexts and settings
- ✓ **coordinators, leaders and managers** who determine programmes and select the assessments and qualifications they believe are fit-for-purpose to secure optimum outcomes for their learners and reflect positively on their staff and institution
- ✓ **awarding organisations (AOs), their processes and personnel** including chief examiners, verifiers and technical experts who devise qualifications based on subject specifications from the regulator. With pre-determined levels of demand and pitch, these are aimed at specific audiences, constituencies, contexts and settings. Responsible for assessment, verification and certification, their concern is to develop instruments and

mechanisms that match expectations and requirements without compromising the integrity of the processes or the credibility of qualifications

- ✓ **quality controller or regulator** decides the criteria, specifications and approval for qualifications and assessment instruments developed by awarding bodies. They are accountable for standards over time and series for each qualification. Comparability and consistency are of particular concern for academic qualifications because of their high stakes role in securing progression to the next phase of education
- ✓ **employers and parents** are often ignored as interested parties and potential beneficiaries of the assessment cycle. Yet parents **invest** enormous resources in supporting children through the system and seek return on investment through the attainments of young people, whereas employers tend to invest in training young people who have already succeeded in education. For parents success is measured by progression further or higher education or employment. For the employer the success and credibility of the system is shown by the availability of motivated and skilled individuals who will make an early contribution to performance and profitability
- ✓ **Government policies and strategies** have increasingly invested in qualifications and assessment. This has meant that targets have been set for qualification achievements. Set out in Public Service Agreement Targets (PSAs), these have raised the stakes for providers, those who lead learning and learners themselves.

The UK has created an interdependent system designed, theoretically, to benefit those at the front end, the learners. However, because of the need to secure accountability for public investment a series of levers has been introduced that all too often places an unacceptable burden on those who deliver the service, rather than invigorating the learning context or releasing the learner's potential,

Each actor in the assessment and qualification ecosystem has specific and distinct needs. I want to demonstrate how digital media, deployed imaginatively and in a coherent and consistent manner, will provide reliable, relevant, valid data and information from diverse sources to satisfy these multi-faceted requirements. They offer the opportunity to eliminate duplication and overlap.

There is an increasing desire to empower front-line delivery offering self-regulation and quality assurance to those leading, managing and delivering learning. At the same time expectations for reach, scale and success increase year on year. The rewards of attainment and achievements through employment, remuneration and other benefits become more sought after as the resources available to secure them diminish.

Digital media offer innovative solutions to many of the challenges faced by those developing assessment by: extending the reach, range and accessibility of learning and assessment; ensuring access for the full range of traditional and non-traditional audiences and constituencies; securing availability across diverse contexts and settings

especially those previously unavailable because of factors like transport and travel; eliminating historical barriers through innovation; engaging non-traditional learners by matching the rhythm of learning and assessment to their everyday experience.

Learning, assessment principles, assessment instrument(s) assessment processes and quality assurance, validation and reporting of assessment decisions are clearly interdependent and inter-related but also by definition discrete. If the commercial and political aspects are set aside each has at its heart a desire to develop, engender and nurture capability, competence, capacity and confidence. This means that individuals will develop the ability to analyse a challenge, problem or situation, be able to project and frame the required outcome, identify the approaches, methodologies and tools that will secure it and then have the abilities needed to deal with it.

For the different audiences and constituencies this will mean that:
✓ each **learner** has a self belief that enables them to realise their potential and progress effectively in life and work
✓ each **practitioner** has a self belief that enables them to respond to each learner in a manner that supports them in realising their potential
✓ each **leader and manager** has belief and confidence in their practitioners' ability to realise the potential of learners
✓ each **awarding organisation** has belief and trust that their processes, procedures and products provide the techniques and tools that enable learners to achieve
✓ each **regulatory authority** has sufficient rigour to ensure that awarding organisations provide coherent, consistent and comparable opportunities for learners over time
✓ each **government department** has a clear understanding of the impact their strategies and policies, delivered by the regulators, have on learning and learners and confidence that the evidence provided on outcomes and progress contributes to maximising the potential of the human capital of all citizens.

Digital media – impact and opportunity

A learner's view

A key challenge for promoters of digital media is to evidence measurable, tangible benefits. Can measurable learning gains be attributed directly to its introduction, on its own or as part of a blend? In the UK interventions such as *Skills for Life* can evidence that for many learners digital media were a powerful engagement trigger. So whilst learning gains are difficult to demonstrate for equivalent learners taught through a blend of traditional and digital facilitated pedagogy, there are people who returned to learning and achieved because digital media offered something different.

Move On, part of the Skills for Life Strategy, was our most successful intervention in promoting education to the public. It aimed to encourage non-traditional learners to

access on-line assessments to 'check-out' their English and Mathematics. It successfully deployed rich digital media, engaging people through interactive skills checks and assessments and by encouraging and stimulating progress to summative assessment. Many access it through the *individual learner route* (ILR), which is for those not involved in formal learning who chose *Move On's* virtual offer of learning and assessment. 44% of 887 586 registered learners (June 09) were on the ILR.

When Move On was launched in September 2002 there were virtually no on-line test centres and no on-line national testing regime for English and Mathematics. By December 2008, 6 479 test centres offered on-screen assessments - over 85% of all national test centres. Learners' responses are reflected in the entry and performance data for these external assessments. In spite of slightly higher success rates for paper-based assessments, the number of entries to on-line assessments is at least double and increasing. As yet no research has been undertaken on the distinctive features of these cohorts in terms of age, gender, educational attainment or learning context.

In the UK external assessments leading to qualifications in English and Mathematics have been available on-line since 2003. Despite uncertainty about technology and limitations of assessment instruments, it has overtaken paper-based assessment.

A practitioner's view

Practitioners play a crucial role in development. Early adopters who were prepared to enhance and enrich learning and assessment opportunities generated much of the momentum that swept away the barriers. Digital media bring benefits to learners by contributing to confidence and engagement. Also deeper levels of analysis and feedback can help with planning of programmes of all kinds and support the drive for personalised and differentiated learning and assessment. Digital media are also contributing to the professional development through the UK's National Centre for Excellence in the Teaching of Mathematics (NCETM).

Qualification-obsessed UK providers often see assessment as negative and pointless, at best deflecting, and at worst switching off, learners and assessors. Traditional assessment took place at set times; results came months later, often after the learner had left the school or college. Digital assessment has revolutionised the process and introduced the means and mechanisms for teachers and learners to access performance data to inform personalised learning and progression.

The *Skills for Life* Strategy helped change perspectives because it had to embrace all potential learners, in schools, colleges, workplaces or the community. When paper-based tests appeared in 2000, teachers resisted because it felt wrong to foist them on people with negative memories of education. This changed because learners demanded a national qualification and enthusiastically embraced the *Skills for Life* on-

line qualifications, which were the first centrally developed external tests at UK NQF Levels 1 and 2, passed to awarding organisations to deliver, support, mark and award. AOs found this offered new opportunities to evaluate performance of:

- ✓ the assessment instrument itself as well as the constituent items and questions
- ✓ assessment judgements of assessors and examiners on pass/fail decisions
- ✓ performance of candidates whether they have passed or failed in respect of:
    - ✓ what they know and don't know judged by the accuracy and speed at which answers are made and the number of attempts on each question
    - ✓ how well candidates know what they seem to know by comparing consistency and coherence across related knowledge, skills and understanding
    - ✓ what candidates need to know to make progress in future. Too much attention is traditionally placed on attaining the pass threshold; little or none to capabilities that successful candidates fail to demonstrate even if they are crucial.

On-line assessment lets AOs provide detailed information on candidate performance so practitioners get feedback on which to base strategies to enhance their teaching.

The quality of teaching is one of the greatest factors that enables each learner to realise their potential. A key challenge is to ensure that teachers' knowledge, skills and understanding remain authentic and current. In 2004 *Making Mathematics Count,* a report by Professor Adrian Smith on the quality of mathematics in the UK, highlighted subject knowledge weakness in many teachers and proposed to set up a National Centre of Excellence in the Teaching of Mathematics (NCETM). This now exists and one of its key roles is to help teachers maintain or improve their skills, through the development of an on-line *self-evaluation tool* (SET) with three inter-related elements: subject knowledge; pedagogy; and embedding (combining them in classroom practice). This is a classic example of digital media used to offer assessment **for** learning. Practitioners work individually or collectively to identify weaknesses, plan programmes to address them and develop strategies for classroom practice.

Leaders' and managers' views

With shrinking resources, leaders must eliminate waste and duplication to secure ROI and increase the impact, reach and uptake of their services. Increasingly digital media provide the means, by helping to compensate for deficiencies and limitations in the assessment cycle. The data helps them management understand how teaching can be improved or sustained by cohort or individual, by year or over time, or for each subject and skill. The detailed feedback it gives helps them to use limited resources effectively.

A regulator's view

Regulators **must** be agnostic about the means of securing outcomes. The key determinants of performance are: adherence to regulation of external qualifications and

specific standards, criteria and specifications. These focus on elements such as: the relationship with the qualification; design of instruments; the environment; access, equality and inclusion; certification; and comparability over time and across series.

Regulators do not usually comment on the use of technology. Where digital media exist AOs need to demonstrate that the assessment still meets all the qualification criteria. There remain sensitivities; for example, for learners with *special requirements*: digital media facilitate the realisation of their potential; for others they can be a major barrier.

Regulatory agnosticism has led AOs to deploy digital media to differentiate and streamline their offer to centres. It also allows them to innovate using digital media. Different AOs have reacted in dramatically different ways.

An AO's view

The UK has over 100 recognised AOs and is committed to increase this diversity. The *Learning and Skills Act 2009* allows employers such as McDonald's Restaurants to become an AO and award qualifications. This complexity means that key players need to differentiate their offer to customers. Some are focusing on the use of digital media.

The Pearson Group, through its Pearson Edexcel, Pearson Solutions and Pearson Vue Brands, is the UK's largest provider of qualifications. Their approach shows how a global company has embraced digital resources to enhance the assessment process. They use digital media to support assessment that meets the needs of the:

✓ **corporate and professional sector** with adaptive digital tools to ensure: integrity through photo-identity, electronic signatures and fingerprint recognition; timely assessment, marking, reporting and certification of performance through on-screen testing, an electronic test bank of pre-trialled items and questions; detailed analysis of current and future candidate performance through evaluation and feedback
✓ **education and skills sector** with on-line offers to candidates and centres including: qualifications from Adult Literacy and Numeracy to GCSEs and GCEs; *Results Plus* access to detailed analysis of specific examinations drilled down to individual item or question level; access to assessment data for leaders, managers and practitioners to inform, improve and target classroom practice in specific subjects and topics; Skills Maps to allow analysis of candidate performance across topics
✓ **assessment community** - *ePen,* an on-line marking solution that streamlines the administration of the assessment system including distribution, storage and tracking assessment papers. *Results Plus* has transformed the approach, form and nature of reporting, making disaggregated data on learner's performance available on-line.
✓ **teaching and learning community** - *Results **Plus** Progress* now offers 'levelled' assessments for Maths and Science at Key Stages 3 and 4 with immediate feedback to help teachers target at topic level and introduce more personalised learning.

An employer's view

In workplaces on-line learning and assessment are increasing access, cost-effectiveness, flexibility, reach and impact. Figure 3 shows how X-ray technicians demonstrate competence using multimedia messaging (MMS) to send images to an assessor.

Figure 3: MMS used to assess an x ray interpretation remotely

Distance assessment also supports distributed industries like construction, logistics and passenger transport. DHL Distribution Services, McDonald's Restaurants and Sainsbury's Supermarkets all use web-based recruitment, training and assessment. Figure 4 shows a mobile phone used for practising the driving theory test and Figure 5 shows a Smartphone used to assess and rehearse speaking and listening.

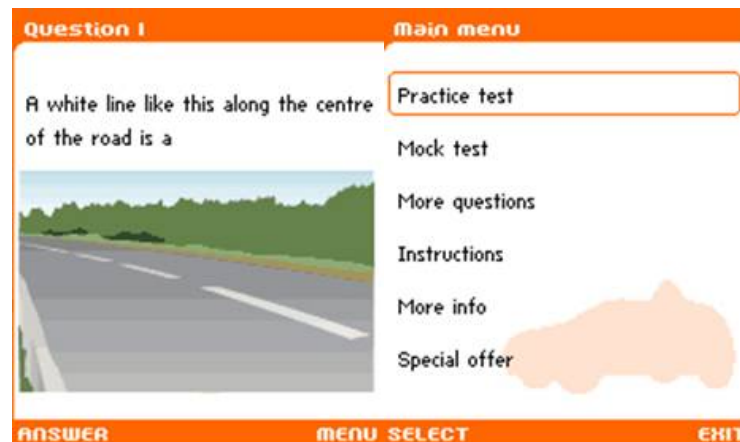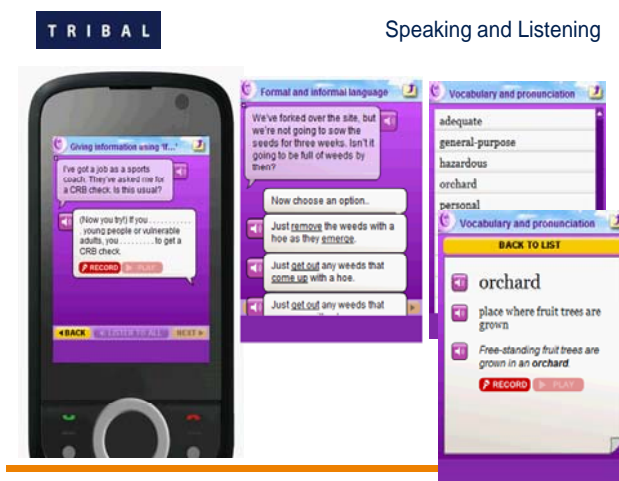**Figure 4: Mobile media used to practise for the Driving Theory Test**

Figure 5: Mobile media deployed to audit then assess speaking and listening

Assessment of capability and competence

This paper provides a brief survey of the contribution that digital media can make to marrying assessment **for** learning with assessment **of** learning. Currently there is no national external assessment regime that coherently, cohesively and consistently assesses an individual's ability in a subject or skill and then requires that this evidence is automatically deployed to enrich and inform future personalised learning. There are many reasons for this ranging from the assessment methodology, the cost of assessment to the focus of assessment itself. An altruistic external assessment methodology should strive to confirm an individual's capability, competence and confidence and that is ambitious, expensive and time-consuming.

Whether based on compensatory, competency, proxy or sampling approaches, insufficient investment in the design and development of assessment instruments means they cannot measure performance holistically, over time. As a consequence their judgements are almost inevitably approximations or estimates. Too often digital media are an after-thought designed to make assessment more acceptable ("cool"), accessible or viable.

If digital media are to become critical elements of any assessment methodology they must be embedded from the outset. Digital media are great enablers and tools for collaboration. As critical elements of assessment design they have the potential to enhance and enrich the teaching process, optimise the talent of all learners and deliver a unified assessment that is both **for** and **of** learning.